TARAHUMAR INDIAN, BARRANCA DE COBRE, MEXICO. *Life Photo* See p. 1.

Quarterly

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NOTICE

Each issue of THE QUARTERLY for 1954 will be devoted to articles in one field of the Museum's endeavor. This issue — Spring, 1954 — features articles concerning Science. The Summer issue will be devoted to Art; followed by issues on Education and History, respectively.

The Editors welcome comments from Association members concerning this policy.

The Tarahumar Indians of the Barranca de Cobre Region of Chihuahua, Mexico

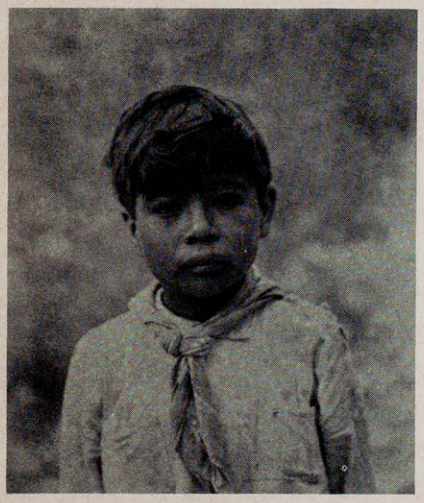
By Robert M. Ariss

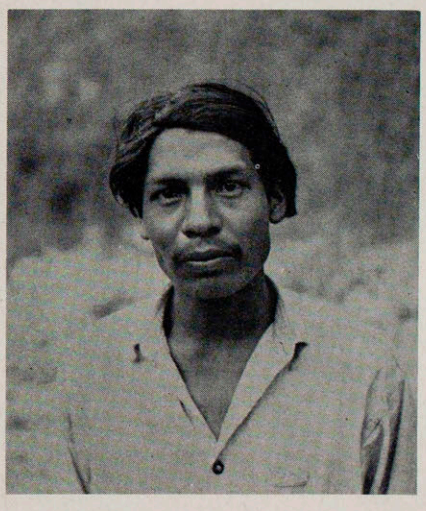
This account constitutes the anthropological aspect of the Los Angeles County Musuem Expedition to the Barranca de Cobre in May-June, 1950. A general account of the expedition by Mr. Kenneth Stager, Curator of Ornithology and Mammalogy, appeared in the Quarterly, volume 9, number 1, and should be read in conjunction with the present writing to obtain a full view of the activities.

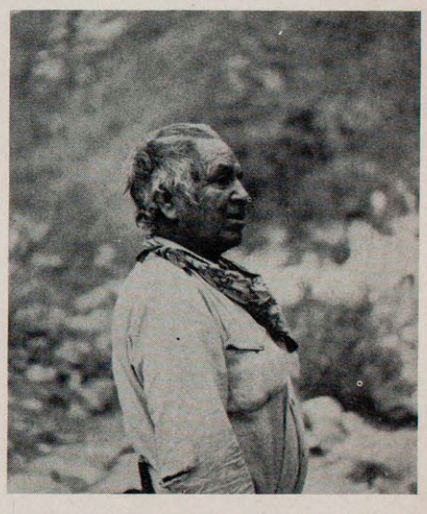
From Alamos, Sonora, the Museum Expedition went eastward into Chihuahua and proceeded in a northeasterly direction to Cumbre at the Barranca rim, thence down to the bottom of the cañon. From here, I took a guide and made a day's spur trip to the east side of the cañon to Guagueybo. The major Tarahumara settlements visited were Metate, Cerocahui, Churo and Guagueybo. The anthropological aims were those of reconnaissance and collection of information and of objects of Tarahumara material culture.

The Tarahumares (from *dara muli*, "foot runners") are the major aboriginal population of the mountainous area of southwestern Chihuahua, Mexico, located 200 to 400 miles south of the U.S.-Mexico boundary. The district Andres del Rio, the general area visited, has a population of 14,000. The total Tarahumara population is 35,232. (Basauri, 1929, p. 13).

The Tarahumara countryside lies at 5000 to 8000 feet elevation and is cut very deeply by stream channels such as that of the Urique (Barranca de Cobre), the Chinipas, and the Batopilas. Only a few Tarahumares live in the Urique cañon bottom. We noted only two ranchos in the section of the barranca bottom we visited. The Tarahumares spend some of the winter in the barrancas in order to escape the cold highland snows. Aside from the two farms noted, the only other activity in the cañon bottom was fishing in the Urique River.







Tarahumar physical types. *Photos by J. Lawrence Murray*

Physical Type

Although no actual measurements were made, the following impressions of the Tarahumares are offered: Skin color is usually dark brown with fewer individuals of yellowish-brown tints and an occasional skin color similar to that of Caucasians. Stature is estimated as medium at about 5 feet 6 inches for men and 5 feet 2 inches for women. Body build is spare to medium, the men especially being rather slender with sharply accentuated musculature. Hair is straight, thick and very dark brown to black. Eyes are predominantly dark brown. Features are

Church at Guagueybo, Chihuahua. *Life Photo*

regular and clean-cut. Teeth are sound in most individuals, including old people. The Tarahumares give the impression of being generally in a good state of health and are capable of strong, sustained physical exertion in traveling on foot and in farming their rugged country.

Language

The aboriginal language of the Tarahumares is akin to that of the Aztecs in the Valley of Mexico. Languages closely related to Tarahumara are spoken by the neighboring Mayo, Tepehuan and Yaqui Indians. As well, languages of some Southern California, Pueblo and Plains tribes also belong in this language family. The Tarahumares now speak Spanish generally. Only two families we visited in the area did not know Spanish so that a Tarahumar interpreter was needed. Schools established by the Mexican Government are the source of this knowledge which apparently is rather recent. (See Bennett and Zingg, 1935, p. xi.)

Archeology

In southern Chihuahua an archeological site showed cultural similarity between early Tarahumara culture and that of the Basketmakers of the American Southwest as indicated by presence of corn, but absence of beans, presence of flexed cyst burials, robes of rabbit skin and turkey feathers, coiled basketry and the construction of circular slab structures. In later times a Cave Dwelling phase was typical with corn-bean-squash agriculture, stone dwellings and turret-like storehouses (*trojes*), use of pottery and a greater emphasis on weaving and twilled basketry. (Bennett & Zingg, 1935, pp. 356-359).

Early cultural similarities to those of the Southwest have persisted to some degree to give a vague Puebloan flavor to Tarahumara culture. Also many traits from more southerly Mexican aboriginal groups have contributed to the total Tarahumara pattern.

History

Although the Tarahumares are generally considered a peaceable people, (in 1950 Father Luis Gallegos of Cerocahui called them *mansos,* "mild-mannered"), their history has included several uprisings against Spanish authority such as those of 1648, 1690 and 1697.

The Jesuit order has been the major Christian missionary organization in this area and has made considerable headway in Christianizing the Tarahumares. Earliest contacts were made from the Tepehuan centers to the south in 1608.

A noteworthy Jesuit missionary was Father Joseph Neumann who wrote a detailed history of his long missionary career among the Tarahumares in Latin. (Dunne, 1948, p. 249). "Cuitego" mentioned as an adjoining town to Sisoguichic (Neumann's home mission) is the Cuiteco near which we passed on our way. Another missionary of note was Father Francis H. Glandorff, a somewhat legendary figure who was recognized as a worker of miracles of the sort that would impress the Tarahumares, namely his ability to cover great distances in an incredibly short time.

There was a decline in the Jesuit missionary program in Tarahumara in the mid 1700's. In 1767 the Jesuits were removed from the Spanish colonies by royal decree for a period of about 100 years after which time they were back among the Tarahumares.

Cerocahui, which we visited on our return from the Barranca, was founded by Father Luis Salvatierra in the 17th century. The dome of the church bears what is probably a 1741 date. Jesuits Andres Lara and Luis Gallegos are now doing a magnificent reconstruction of this church with but scant material and a small labor force at their disposal. This Jesuit establishment has a bright, new school, shops and quarters for the Religious alongside a church which was in use before the 1767 expulsion of the Order from the then Spanish colonial Mexico.

At Churo and Guagueybo there are also large churches, but these are maintained by the *maestros,* or Indian prayer leaders.

Actually the Barranca de Cobre area is little mentioned in missionary writings. The Urique river cañon served as a refuge area for Indians who fled from the discipline of the missions. The Bar-

ranca was mentioned by Father Juan Maria Salvatierra in 1684 when he received a great fright upon looking into the Urique cañon. (Dunne, 1948, p. 3). Another Jesuit, Martin Benavides recorded the aw-inspiring vistas along the Urique in 1724. (Dunne, 1948, p. 201).

Material Culture

The Tarahumares depend on agriculture and stock-raising for their sustenance. Agriculture was affected by Spanish practices after 1600, although the Tarahumares probably practiced cultivation of corn, beans and squash in pre-Spanish times by means of digging and planting sticks which can still be seen in use today. Of Spanish introduction are: use of the wooden plough pulled by oxen, use of manure of domestic animals for fertilizer and the growing of several cultivated plants such as wheat, peaches, apples and apricots.

In stock raising, second in importance to agriculture as a source for food, the Tarahumares have borrowed even more extensively from the Spanish. Nearly all the domesticated animals the Taramumares possess were introduced into the New World by the Spaniards, for example: cattle, sheep, goats, horses, mules, burros, pigs, and chickens. Meat and skins are the chief products derived from cattle. Goats supply milk which is made into cheese, and sheep provide wool for weaving. Horses and mules are used as draft animals. Horses are not killed for food, but they are eaten if they die. Oxen, though used chiefly as plow animals, are occasionally slaughtered for food on ceremonial occasions. Chickens are kept for both meat and eggs. The Tarahumares do not make much use of pack animals or mounts; these Indians are usually seen walking, which is perhaps safer and is probably as rapid a means of travel as riding in this very steep terrain.

There seemed to be little emphasis on hunting among the Tarahumares in contrast to neighboring Mexicans who often carried deer rifles. We did, however, see the Tarahumares fishing in the Barranca bottom on the morning we arrived there.

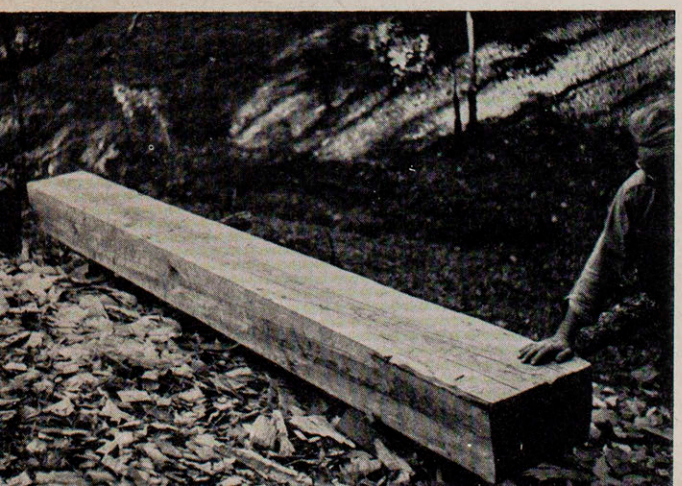
The Tarahumares are a very resourceful people in supplying their own needs, though lately they have been drifting away from their settlements to follow seasonal work. Occasionally there are stores in their towns and they buy at nearby Mexican villages. Also *vayuqueros,* or peddlers with pack trains, bring in yardage goods, hand tools, canned goods and toiletries from the more Mexicanized areas. Articles of clothing such as shirts and trousers are now bought, whereas formerly they were made at home. Leather *huaraches* (sandals) are still made locally. More rarely sandals are of bark. Hats for both men and women are woven of *cojoyo* palm leaves, though women usually wear a print bandana or a black scarf on the head. Clothing is urgently needed and much repaired before being discarded. Women now wear ready-made cotton print dresses as much as home-tailored cotton blouses and skirts. Women go either barefooted or wear factory made shoes more rarely. Decoration, which is rare, is chiefly in the form of glass bead necklaces, often with a crucifix as a terminal pendant.

Wood is plentiful in the upland areas, and is extensively used by the Tarahumares for houses, tool handles, kitchen vessels, ceremonial and athletic equipment.

The Tarahumares have had iron tools for many generations and have become excellent woodsmen. They fell and trim pine trunks about 1½ feet in diameter for sawing into rough lumber which they use in making furniture and for finishing house interiors. The current employment of many Tarahumar men in lumbering has taught them to fashion wood by hand methods so that the final product resembles machine-cut lumber. (See photo).

The Tarahumares make a log cabin style house

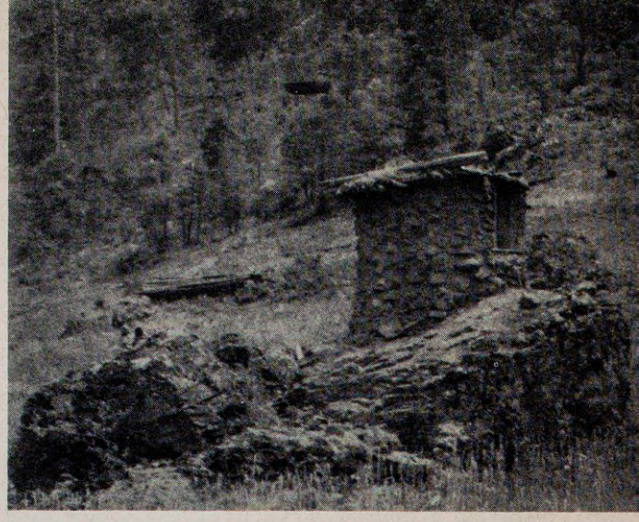
Pine log trimmed by Tarahumares, and Tarahumara log house near El Muerto, Chihuahua. *Photos by J. Lawrence Murray*



that resembles that of American frontier days in the middle Eastern part of our country. (See photo). The major room of these houses is usually about 10 feet square. The Tarahumares have learned, probably relatively recently, to make shingles (*tabletas*) for the style of gabled roof now in use. The shingle is of pine, measuring ¼ inch thick, 4 inches wide, and about 30 inches long. These shingles are cleverly secured to roof cross-pieces by use of 8-inch tapered pine nails (*tarujos*) whose points can be seen protruding through the under side of the roof. There is usually an open attic under the gabled roof. The roof is supported by dressed poles resting on masonry or log walls. Occasionally the walls of the houses are of adobe bricks or of masonry. Sometimes the Tarahumares take advantage of cave shelters, either open or enclosed by a wooden wall. It is likely that caves were more extensively used in pre-Spanish times before iron tools were available for making planking.

Some ceremonial items are made of wood such as the *coronas* (crowns) for the Matachina dancers; gourd rattles and dance wands have wooden handles. Good copies of violins and guitars are made using wood, glue and stringing materials at hand. Horsehair is used to supply the fiber for the violin bow. On a violin obtained at Cusaraga, there was a neat little turnbuckle arrangement to tighten the horsehair string on the bow.

Ana Caballero, Tarahumara of Guagueybo, Chihuahua, grinding corn.
Life Photo



***Troje*, or masonry grain storehouse near El Cajon, Chihuahua.**
Photo by J. Lawrence Murray

Another article of woodcraft is the large *batea* (bowl) hollowed from a section of a tree trunk. Some of these *bateas* measure two feet in diameter. The *batea* is used to catch *masa* (ground corn) as it comes off the *metate* (grinding stone).

Stone work is confined chiefly to masonry houses, to fences for the fields or to *trojes* which are small grain storehouses (See photo). The stone corn-grinder, known as *metate,* and *mano* (hand stone) are common examples of Tarahumar stone work. Even these basic kitchen devices at which Tarahumara housewives spend most of their working hours are beginning to be replaced by a grinder similar to the meat grinders so common in our own kitchens but a short while ago. (See photo).

Pottery making is extensive and is women's work. A brown to orange colored plain pottery is made. Painted pottery is said to have been made recently, but we saw none of it. All sorts of utility ware such as bowls, plates, cups and large *tesguin* (Tarahumara corn beer) containers are made by wrapping cylindrical strings of clay into a desired shape, smoothing and finally firing the vessel.

Good woven basketry with a diagonal weave (twilling) is made by the women, from the leaves of the *cojoyo* palm and the *sotol* plant. The basketry is used chiefly for food storage. The same technique is used in the weaving of hats which are double-crowned, serviceable and cool.

Tarahumara women weave a blanket of sheep wool. They prepare yarn of white or of brownish-black wool, twirling it to the proper thickness by rolling it on the thigh aided by use of a spindle (*malacate*). The loom is placed on the ground and the weaver shuttles the thick, loosely spun weft threads between the thin, tightly spun warp threads. The blanket is loosely woven to afford the wearer more warmth. Colors are grayish-white, brownish-

black or grey, with or without colored designs. Recently factory prepared dyes are coming into more use.

but today mining is more typical of the area down river near the settlement of Urique according to information given us.

Tarahumara craftsmanship, while not exquisite, is at least serviceable. Some articles show considerable skill in their manufacture. For instance, some of the pottery pieces have interesting shapes and color contrasts made by blackened areas developed in the course of firing. Scalloped rims are sometimes made on bowls by way of ornamentation. Baskets have interesting shapes and regular weave. Blankets and sashes are well woven.

In the area we visited, the Tarahumares were living in small farming settlements interspersed with larger villages such as Metate, Churo or Guagueybo whose populations ranged from 100 to 900 people.

The number of men in these villages seemed small and we were told that many of them were away from their land working in mines, at saw-mills or on Mexican highways. With the beginning of the rainy season about the end of June, these men return home to plant, remaining at home until the harvest in late October or early November.

Mining was an early activity in this area which led to racial and cultural contacts with Europeans. We saw evidence of such old mines along the way,

Non-Material Culture

Political Structure

Political officials are elected by vote of the people, although there is a previous discussion to narrow the number of candidates. Elections are usually held during Holy Week, as most of the people come to the larger towns to be at the churches for the festivities. The *gobernador* is the chief official. He is responsible for upkeep of the church and for encouraging church attendance. Also he represents the town in arranging inter-town athletic contests such as races, kick-ball and *palillo* (hockey) games. Another important duty of the *gobernador* is to represent the town in contacts with outsiders, chiefly in regard to Mexican federal and state officials and other visitors. As we arrived at Metate on our return, *gobernador* Jesus Patino had just returned from Chihuahua City where he had discussed with the state governor intrusion of Mexican farmers on town lands. I listened to part of the town meeting in the schoolhouse the next day wherein the results of this interview were summarized for the town council by Manuel Marquez, Metate school teacher.

The *gobernador* holds office for at least one year

Tarahumar boys playing *palillo*. Metate, Chihuahua.
Life Photo

and as long as his policies and personality find support among the town people. Terms of ten years have been known. If the *gobernador* wishes to resign or loses favor, he holds a meeting, probably during Holy Week, and supervises the election of his successor from candidates acceptable to the people. Vote is taken by voice. The symbol of office is the wooden cane, usually of chocolate-colored Brazil wood with perhaps a silver ornament on it. The *gobernador* has an advisory group of *mayores* (subordinates) acting as a council, a *teniente,* (lieutenant governor) and other auxiliary officers known as *suplentes* or *alcaldes*. *Fiscales* act as messengers for the *mayores* and are concerned with the punishment of children. *Capitan* is the title of those who deliver official messages for the *gobernador*. The office of *capitan* entails much running and is usually held by young men. An officer known as *dopili* has charge of the canes of office associated with these officials.

Social distinction is the only reward attaching to these positions. No one who is elected may, according to custom, refuse to serve, nor may he serve for less than a year.

Marriage and Family

The Tarahumara family has a strong economic orientation. Each party brings property to the marriage and each has a set of duties to perform. The man must take care of the farming, build the house and purchase material from which to make clothing. The woman prepares food, weaves blankets, and makes pottery and basketry. Men, women or children herd animals—with the absence of the men working for wages now, this task falls more and more on the older children and the women.

The Tarahumara family unit of man, wife and a few children performs the activities of agriculture, stock raising and home industries very well indeed. Either party to a marriage may leave if there is

Matachina dance. Metate, Chihuahua.

abuse, neglect or bad faith on the part of the other. Divorce is informal, though marriage is a matter of considerable legal attention on the part of the *mayores* and *fiscales*. After religious ceremonies there is considerable conventionalized drinking (*tesguinadas*) accompanied by sexual freedom, though the latter is among Tarahumares only. This is doubtless an aboriginal pattern surviving in spite of Spanish-Mexican church and governmental disapproval.

Games

There is a great interest in games in this area and running is an important element in the contests. Inter-town competitions are arranged, or an equal number of participants within a town oppose one another. Often there is betting, especially in the more formalized contests. We watched many *palillo* games while in the area. A wooden ball is propelled by a three-foot stick with a spoon-like end, much as in our game of hockey. Kick-ball consists of two teams competing, each propelling a ball around a fixed course by use of the feet. The team which gets a whole lap ahead of its opponents wins the contest.

Women have a running game wherein they advance a four-inch ring around a course by means of sticks held in the hand. The object of the game is similar to that of kick-ball.

At Metate one Sunday afternoon we watched a men's and a women's race going concurrently over rather hilly terrain. Later we saw the victorious men's team collect the money all the participants to the contest had bet.

Religion

Most Tarahumares are nominal Christians. The Christianized Tarahumares have kept a little of their Pagan observances with which they have combined a great deal of Christian lore into a fused system of religious belief.

In 1929 Basauri (1929, p. 13) listed but 1400 Pagan Tarahumares in the district of Andres del Rio. The total district population is 14,000 so the percentage is only 10% that are non-Christianized. According to the same census, all but 400 of the Pagan Tarahumares live in Andres del Rio district.

The church is the center of social and religious life in the larger communities we visited. The Indians themselves maintain the church and the services except in the few areas where Catholic officials are present, as at Cerocahui.

The Indian religious official is known as *maestro*. He annnounces church on Sunday by ringing the bells. When he believes all the townspeople are ready for services, he lights the candles at the altar and kneels there praying aloud. Men leave their hats outside, enter the church and lean against the left wall or sit on the bench there. The women are usually similarly located on the right side of the church. Only a few kneel. The service is short, consisting of a recitation of prayers led by the *maestro*. During the praying the people are silent until the *maestro* stops, whereupon they respond in unison with prayers, crossing themselves from forehead, chin, shoulders and chest. When the ceremony is finished, the *gobernador* gives his weekly sermon outside the church.

When the Los Angeles County Museum party reached Cumbre, Chihuahua on the edge of the Barranca de Cobre, it was decided to camp for a day or so in order to get a suitable picture of the sun coming up over the rim of the cañon. We arrived at Cumbre on the 14th of May, the eve of the Feast of San Ysidro Labrador, patron Saint of agricultural workers. Four of us returned to Churo to attend the Fiesta there. We arrived at the scene of the ceremony, the rancho of Don Julian Villalobos about 9 P.M., locating it by dynamite blasts being set off in honor of the Saint.

We were invited to eat. An ox had been slaughtered for food and tortillas were being prepared inside the house. The bladder of the ox was inflated and was used as a hand drum by the *Pascola* dancer who was dancing to violin and guitar music in front of an altar dedicated to San Ysidro Labrador. The *Pascola* dancer was dressed in the usual costume, but in addition wore strings of cocoon rattles wrapped about his ankles. Dancing lasted until midnight after which prayers and responses were said before the altar, accompanied by occasional blasts from "firecrackers" consisting of part of a stick of dynamite exploded by cap and fuse.

After a brief, uncomfortable sleep on the porch of the house adjacent to the room including the altar, we awoke to a very cold dawn, breakfast and a resumption of the dancing before the altar and shrine of San Ysidro. After sun-up, the shrine portion was removed from the altar and placed on the

head of our host Don Julian Villalobos, who walked about a mile and a half to the Churo church where services and dancing were continued. The shrine of San Ysidro was then taken back to the Villalobos rancho by a different route through the fields. At the rancho, a libation, or offering of *tesguin* (corn beer), was made to the cardinal points by a ceremonialist who was dressed in the older style jacket and knee length pantaloons of unbleached cotton. A *Matachina* dance was given in the morning performance and finally food and *tesguin* were brought out first for the performers and then for the congregation. We ate the tasty dishes and drank the pungent, bitter fermented *tesguin,* (sparingly, as we heard that it was very potent) and went on our way back over the very trying trail to Cumbre, where I for one went to bed in the middle of the afternoon out of sheer exhaustion.

Tarahumara Cultural Orientations

Much has been said about Tarahumara character. The missionary evaluations vary between tractable and that of a stubborn, resistant deceitful people doubtfully worth the effort to convert to Christianity. It has been popular to point out how deceitful the Tarahumares are. Of course they would be on guard toward representatives of church and governmental bodies who might be seeking to bring about Tarahumara abandonment of local practices in favor of outside ones.

From the evident successes of the Jesuit missionary program in earlier years as well as at present, and the recent Mexicanization of the Tarahumares, it would seem that they are able to adapt themselves considerably to new cultural patterns, although they are also retentive of much of their more particularized tradition. I found them generally frank and cooperative in offering ethnographic information. I recall many gifts and acts of generosity from them after I explained my purposes there. Don Julian Villalobos, host of the Fiesta of San Ysidro Labrador at Churo, even suggested moving picture coverage for the ceremony. It was relatively easy to obtain singers and musicians for recording, and performances of *Matachina* and *Yumari* dances were arranged at our request at Metate, Chihuahua. My experiences with the Tarahumares were most pleasant, though unfortunately there was too little time available for more extensive inquiries there.

Conclusions

The Urique section, because of its inaccessibility, seems to have been a refuge area for those wishing to avoid Spanish-Mexican contacts. Because of this isolation the area was not thoroughly missionized and consequently retains a higher non-Christian population than other portions of Tarahumara. Even so, there was considerable contact with Europeans in Spanish and Mexican times, which has added a veneer of European traits to both material and ceremonial aspects of Tarahumara culture there.

The isolation of the Urique area is gradually disappearing. Roads are approaching from the west to Descanso, Sinaloa, and from the north via Creel and Norogachic, Chihuahua. Industries providing employment for Tarahumar men such as timbering and road building draw them away from their settlements in between their agricultural activities. The *Vayuqueros*, as in previous years, are bringing in goods, now of modern manufacture, so that the Tarahumares are dressing in factory made attire for the most part. Disappearance of the old costume is an indication of the rapid changes taking place among the Tarahumares in the Barranca area. Cosmetics are even becoming popular.

The Spanish free town organization was introduced throughout Tarahumara in early colonial times. Lately Mexican political patterns such as the *ejido* (public land assignment program) have been made a part of Tarahumara economy in this area. The *gobernadores* of the major towns visit higher Mexican officials in Chihuahua City on occasion to discuss political matters.

Spanish is now a second language in the Barranca de Cobre area, although apparently it was little used 20 years ago.

Church activities under the Jesuits have been reestablished since the latter part of the 19th century. The earlier Indian-Spanish cultural blend is now undergoing a rapid modern Mexicanization. A few Americans with mining interests have lived in the immediate area of the Barranca and have contributed somewhat to the rapid cultural changes that are underway currently there.

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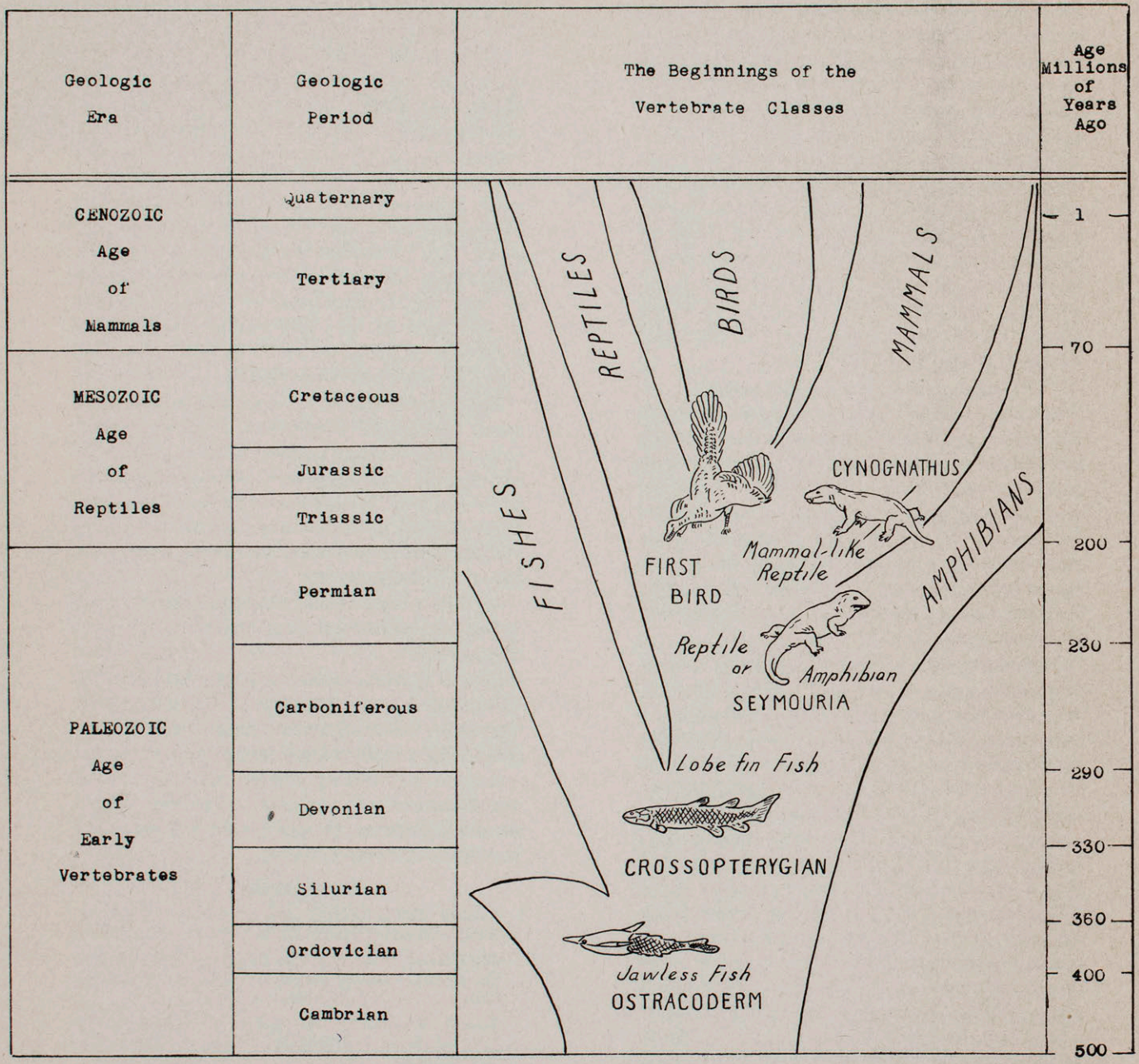


Fig. 1. The geologic time scale showing time relationships of some examples of "link forms" that led to the later vertebrate classes.

Some "Link Forms" in the History of Vertebrate Life

One has little difficulty in recognizing the main groups of vertebrates today; the finned fish, the smooth skinned amphibian, the scaly reptile, the feathered bird and the fur bearing mammal. But millions of years ago, when these groups (or Classes, as they are scientifically called) were getting their start on earth, the lines of distinction were not so clearly marked. Our knowledge of the history of vertebrate life comes from a study of the fossil records. These records, though scattered and incomplete, are amazingly good. To be sure it is usually only the petrified skeletons which remain as evidence of these ancient creatures, but with an understanding of anatomy, the remarkable story of the development of the various groups of backboned animals unfolds. In the Museum's Fossil Unit in the Hall of Evolving Life, examples of these critical records are displayed.

The first fossil vertebrates on record are the Ostracoderms, "shell skinned" animals from the rocks of Ordovician time, living about 400 million years ago (see fig. 1). These Ordovician Ostracoderms had already developed or evolved into two main groups, one represented by a specialized, bizarre type such as *Pteraspis* (fig. 2) and another simple group, the Anaspids, related to the present day lamprey "eels." Like the modern lampreys, the 400 million-year-old Anaspids and Pteraspids had jawless mouths and an opening for the nostril on top of the head. The Ostracoderms differed from the lampreys of today, however, in the presence of hard bony skeletons. The rocks which bear these first vertebrates suggest that these animals lived in fresh water, and their body plan presupposes bottom-dwelling habits.

The finding of a truly "link form" in the fossil record always creates excitement in paleontological circles. The first records of important vertebrate "link forms" are known from the Devonian period.

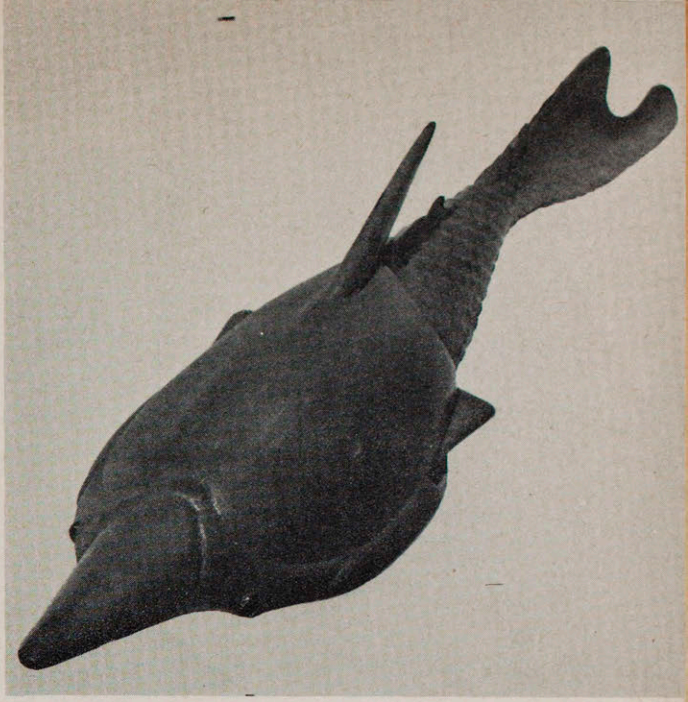
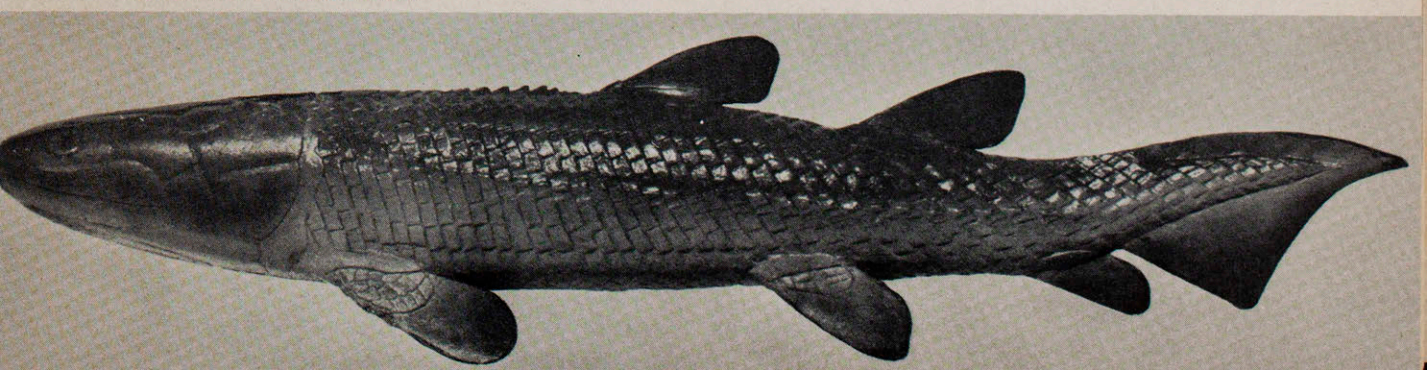


Fig. 2. The jawless "fish" *Pteraspis*, an Ostracoderm with shell-like protective plates. It was about nine inches long. Model by Leonard C. Bessom in the Museum exhibit.

These are the Crossopterygians, and there are twenty or more distinct types known from the rocks of the old and new world, all of which exhibit structures indicating that they were animals intermediate between strictly aquatic types and partially land-dwelling, amphibian forms. They had nostrils, associated with lung breathing, and remarkable front fins that were limb-like, fleshy paddles (see figs. 3 and 4). The basic bones of the arm (humerus, radius and ulna) all characteristic of later land vertebrates, can be identified in these fossils, but the terminal bones were still fish-like fin rays. These "fish" were fresh water types and undoubtedly pushed themselves about on land for brief periods of time. The Devonian period was a time of fluctuating climate; often there were seasons of drought which in all likelihood left these animals stranded out of water. Presumably their primitive "lungs" made survival possible for limited periods until they could move themselves with their crude limbs down to the water at lower levels.

Fig. 3. A Crossopterygian, *Osteolepis*, from the Devonian, about 300 million years ago. It had limb-like front fins and internal lungs; and was thus equipped to live on land for brief periods of time. It was about nine inches long. Model by Leonard C. Bessom in the Museum exhibit.



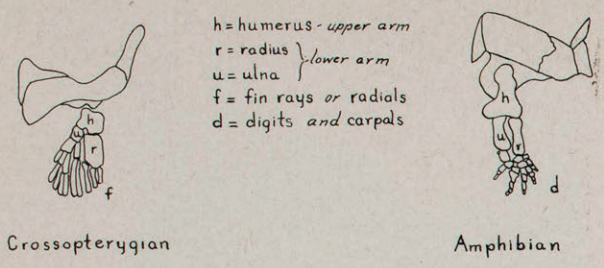


Fig. 4. The fore limb bones in a primitive fish, a Crossopterygian, as compared with the limb of its descendant, an early amphibian; showing, in both, similar basic parts. Adapted from Romer, The Vertebrate Body, 1949.

This period in the history of vertebrate life was a particularly important one. Once vertebrate animals were able to survive out of the water, there were limitless opportunities for the development of life and the beginnings of entirely new classes of animals.

The amphibians represent the most primitive Class of land-dwelling vertebrates. They must hatch their eggs in water, their larval stages are incapable of air-breathing, and even the adults spend much of their existence in damp surroundings. They are thus restricted in their land roving, a fact which is reflected in their squat bodies and often sprawling limbs.

The physiological changes necessary to free the aquatic vertebrate for semi-aquatic life continued to be active until strictly land-dwelling forms were developed. So slow was this process, however, that only the perspective of time brings it into focus. About one hundred million years after the appearance of the Crossopterygians, the fossil record reveals the first evidence of reptiles. To the casual observer the skeletal differences between the land-dwelling reptile, and the semi-aquatic amphibian may not be obvious, but to the scientist trained in the study of anatomy, they are clearly marked and distinguishable. In the Permian of Texas, the fossil record has yielded a squat, four-legged creature which goes by the name of *Seymouria* (fig. 6). This animal has the specialists hard pressed to determine its proper category. In many characters, *Seymouria* is a good amphibian, but in equally as many it is reptilian.

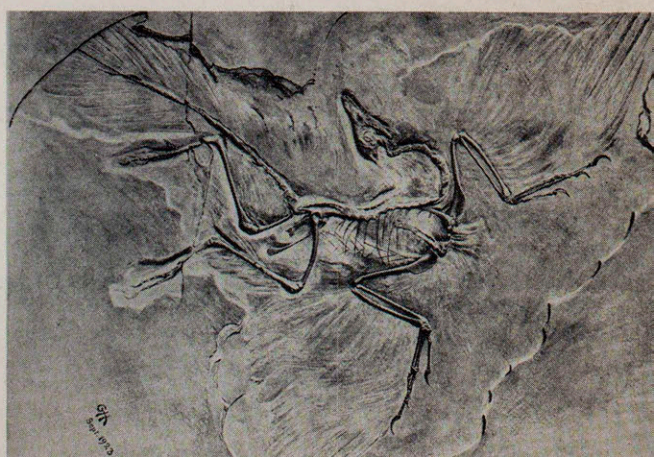
The Class Reptilia has had a long and varied existence. Appearing first in the Paleozoic, it became the dominant group of animals throughout the Mesozoic, (when the many forms of dinosaurs developed) then dwindled out in the Cenozoic until today lizards, snakes, crocodiles and turtles are all that remain. In the course of its long history, two very significant outgrowths have come from the reptile group—the birds and the mammals.

The first known birds, *Archaeornis* (fig. 5) and *Archaeopteryx,* were found in Germany in the lithographic shale deposits of Jurassic age (about 150 million years ago). The unusually fortunate preservation of impressions of feathers with the fossil bone indicates a typical avian feature was present in these animals, yet they had lizard-like teeth, and a long, bony, lizard-like tail. The hand and wrist elements were not fused as in modern birds, each finger tip (wing tip) bore a claw, and their hind limbs were adapted to running, possibly in the manner of a small, bipedal (upright) dinosaur. These two records of "link forms" from reptile to bird are indeed meager, but the evidence unquestionably indicates that there was an evolution from the reptile to the bird. Later fossil birds and recent ones substantiate this evidence in that they retain reptilian traits such as the occurrence of several separate bones in the jaw and similar basic plan of development of the feather and the scale.

Even before the appearance of birds, in late Paleozoic and early Mesozoic time, some 200 million years ago, there lived and thrived an important group of reptiles, the Therapsids. They are commonly called mammal-like reptiles, and they represent a significant "link group" in the history of vertebrate life. The Karoo beds of South Africa have produced hundreds of specimens of various shapes and sizes all representing this Order. *Cynognathus* (fig. 7), a member of this group shown in the Museum's display, demonstrates a transition or "link" form from which mammals probably arose. A comparison of critical features as seen in a typical reptile, a mammal-like reptile (*Cynognathus*), and a typical mammal shows how paleontologists are able to recognize intermediate structures on the basis of comparative osteology (see table).

Evidence indicates that from small mammal-like reptiles such as *Cynognathus*, the true mammals descended. The first fossil evidence of true mammals occurs in the Jurassic, at which time they were tiny creatures quite subordinate to the ruling rep-

Fig. 5. The first bird, *Archaeornis*, from the Jurassic of Germany, 150 million years ago. The original skeleton and imprint of wing and tail feathers are clearly indicated. The skull was about two inches long. After Heilmann. A cast of this specimen appears in the Museum exhibit.



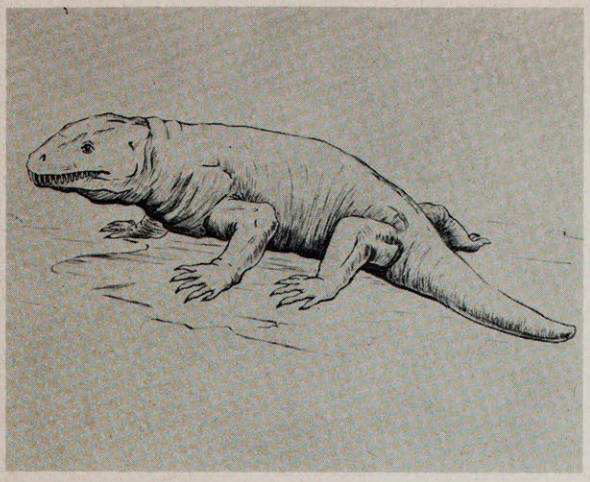


Fig. 6. *Seymouria*, a primitive amphibian (?) or reptile (?) that lived in Texas during Permian times, 230 million years ago. It was about a yard in length. Background drawing by Gordon Pond, in Museum exhibit.

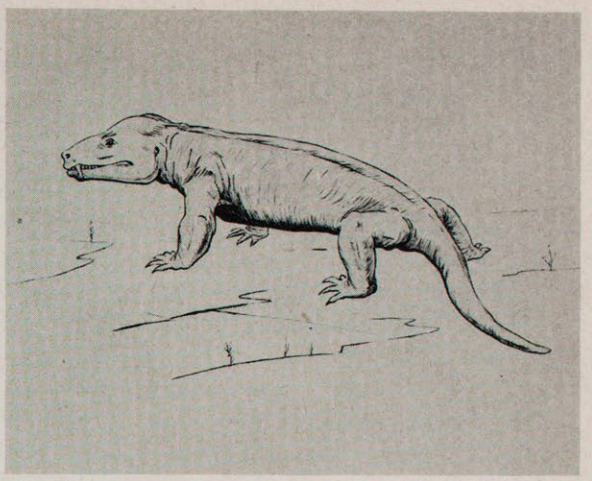


Fig. 7. *Cynognathus*, an active, strong limbed mammal-like reptile from the Triassic of Africa, about 200 million years ago; reptiles of this type were the ancestors of later mammals. They ranged from four to five feet in length. Background drawing by Gordon Pond, in the Museum exhibit.

Critical Features	Reptiles	Mammal-like Reptile	Mammals
Skull	Many bones	Intermediate number	Few bones
Jaws	Many bones	Many bones but one enlarged (dentary)	One bone (dentary)
Connection of jaws with skull	"Hinge" bone intervenes	Reduced "hinge" bone intervenes	Direct connection of jaw with skull
Position of legs	Turned out from body in sprawling position	Under the body, knee forward, elbow back	Under the body, knee forward, elbow back
Teeth	All alike (pointed)	Slightly differentiated but simple	Differentiated (canines, molars, etc.)

tile group. Before the end of the Mesozoic, mammals were more varied, but not until the beginning of the Cenozoic did they begin to flourish.

With the extinction of the great mass of dominant reptilian forms at the end of the Mesozoic, and through the 70 million years which have elapsed since the beginning of the Cenozoic Era, hordes of diverse forms of mammals have evolved, multiplied in numbers and—in many cases—have become extinct. Man represents a very late development of this vast complex of vertebrate life.

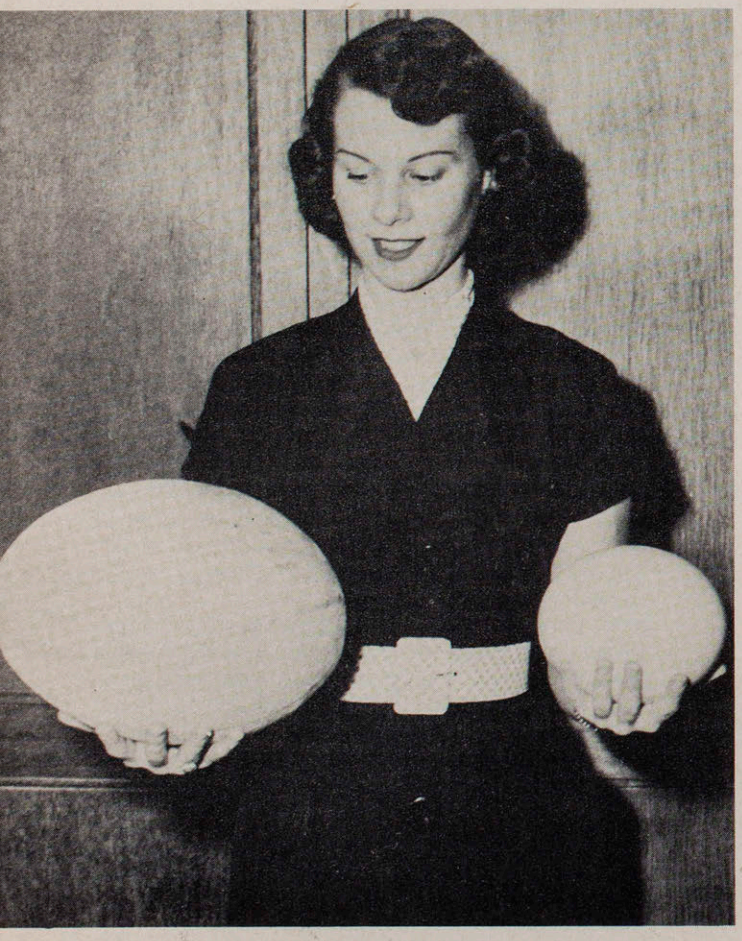
Among the various "link forms" which tell us of the origins of what later became the major vertebrate classes, it would be hard to say which are the most significant in vertebrate history. Perhaps we would be inclined to choose the Therapsid reptiles, which led to mammals and thence to man himself. However, at the time when the Crossopterygians were forced to maneuver on land, significant new opportunities for life and places to live presented themselves. We are inclined, therefore, to rate this as the most critical step in the history of the vertebrates. For without this step it is impossible to visualize the development of the later important classes.

Theodore Downs
Curator, Vertebrate Paleontology

The Elephant Bird

An Extinct Flightless Genus from Madagascar

Some twenty-five years ago I was the director of the Zoological Expedition to Madagascar jointly organized by the National Museum of Natural History, Paris, the British Museum, London, and the American Museum, New York. I was in the field the greatest part of the year 1929, and I left there, for another two years, two members of my international staff: Dr. Austin Rand, now Curator of Birds at the Chicago Natural History Museum, and Mr. R. Archbold. Mr. J. C. Greenway, at present Curator of Birds at the Museum of Comparative Zoology, Cambridge, Massachusetts, and several French and British naturalists had also accompanied me. Some of them were just out of college in those days, and it was their first field trip. We were mostly concerned with collecting birds and mammals and we eventually gathered over 20,000 of them, a number of which were then new, and others extremely rare. We also had with us a collector of fossils from the British Museum, Dr. J. C. White, an expert with Permian fishes. But none of us was particularly concerned with the study of the giant extinct birds of the island, the Elephant Birds *(Aepyornis)*, sometimes identified with the legendary "Roc" of Marco Polo and the Arab authors.



Miss Barbara Schultze compares Aepyornis egg with ostrich egg. Discoloration of Aepyornis egg resulted from burial. It is not striped!

The local Museum of Tananarive, however, was full of their huge and massive skeletons and of their stupendous eggs. I had already seen them in Paris and elsewhere, but the Tananarive series was particularly impressive, and I then realized how exceptionally interesting those astounding remains of giant subfossil birds could be.

Aepyornis used to roam Madagascar until perhaps less than a thousand years ago, but did not survive long the colonization of the island by man. Whether they were killed out, or they died owing to the disruption of their habitat is not yet clear. Their fate, incidentally, was shared by the endemic Hippopotamus, which was somewhat intermediate between the two present African species.

Aepyornis was represented by several species, all large. The biggest, *Aepyornis maximus,* was slightly higher than an ostrich and several times heavier; in fact, the heaviest of all known birds — its egg the largest known. The related Madagascar genus, *Mullerornis,* was considerably more slender, and the great Moas *(Dinornis)* from New Zealand, some of them rather taller than the Aepyornis, never approached their weight.

Today, five large flightless sorts of birds, more or

MOAS ON THE RUN

The Moas of New Zealand were the tallest birds so far known to have existed, but the Aepyornis of Madagascar was considerably heavier.

Painting by Charles A. Knight

less similar to *Aepyornis, Dinornis* and allied genera, are still found: in Africa and Asia Minor, the Ostriches *(Struthio);* in South America, the Rheas *(Rhea);* in Australasia, the Emus *(Dromiceus)* and the Cassowaries *(Casuarius),* and in New Zealand, the smaller Kiwis *(Apteryx).*

The relationship of these various flightless birds is still being discussed, but they certainly are not as nearly connected as one might think and it has long been more or less accepted. Early in the Teriary Era, or even before, birds were already well defined and their general structure finally set. The only notable evolutional fact since has been from time to time a return of some to terrestrial life, through a reduction of the wings. The present large flightless birds, and the recently extinct Moas and Elephant Birds show such differences in their anatomy, particularly the skull and the bony palate, that it seems highly arbitrary to unite them in a single order. Possibly the Rheas are related to another order of nearly flightless birds of South America, the Tinamous. And recent studies suggest that *Aepyornis, Dinornis* and the still living *Apteryx* (Kiwis) could be included in the same order, their anatomy being generally similar; these three birds had unusually thick and powerful legs and laid huge eggs for their size. Others, however, certainly recall different groups of flying birds and their apparent, but superficial resemblance is the effect of coincidence.

The remains of *Aepyornis* are abundantly distributed in the Pleistocene and sub-actual deposits, particularly alluvions, of Madagascar. Some are recent enough to show samples of skin and feathers. The eggs, the biggest ever found, are also met with now and then, often in an excellent state of conservation. I was able to acquire several of them. They constitute one of the most interesting ornithological exhibits in museums and one of them, a particularly large and well preserved specimen, is now adorning our Bird Hall. It measures 12 inches by 9½ inches and has a capacity of about two gallons.

The Aepyornis were woodland birds, feeding on leaves and fruit, of which they no doubt consumed enormous quantities, and the disappearance of the forests of the main plateau of Madagascar, burnt by the early human invaders of the island, has probably greatly contributed to their extinction.

J. Delacour
Director

Jade Clues in Mexican Archives

Jade was a token of distinction in ancient Mexico. Every noble of the Mexican court wanted as many as possible of the royal green stones to demonstrate his rank and wealth. Also jade had a wide reputation for supernatural powers, besides its notable significance in sculpture. Historians, therefore, as well as anthropologists, artists, and archeologists have much to interest them in jade. But when they asked the natives where the ancient lapidaries obtained their crude stones for carving, no one seemed to know.

Because of this, some students of antiquities turned to the belief that the rough stones had been brought, somehow, from the Orient. Meantime, petrologists had become interested in the problem, and, upon analyzing fragments from the Mexican carvings, they found that these stones, though similar, were distinct from the Burmese jadeite. The differences were not such as to assign the Mexican stones to another mineral species but they were typical enough to distinguish them from the Oriental variety. Thus, it became a problem for mineralogists to find the local sources of the natural stone from which the ancient images had been carved.

Mere chance might sometime uncover a hidden vein, but for a deliberate search there are certain areal limitations that might reasonably serve to localize the extent of the ground for likely discoveries. First, almost without exception, all archeological jades have been found south of a line drawn east and west through the northern end of the Valley of Mexico. Then, those who have studied the geologic sciences know that only in areas of metamorphic rocks could they expect to find a deposit of that rare mineral. So, these considerations have served to exclude many of the States of Mexico from the likelihood of finding any lost jade mines, and to limit the areas of others. Even so, there remain so many hectares of metamorphic rocks that, in the hope of leading to earlier discovery, some more restrictive clues have been sought in the fragmentary archives of ancient Mexico.

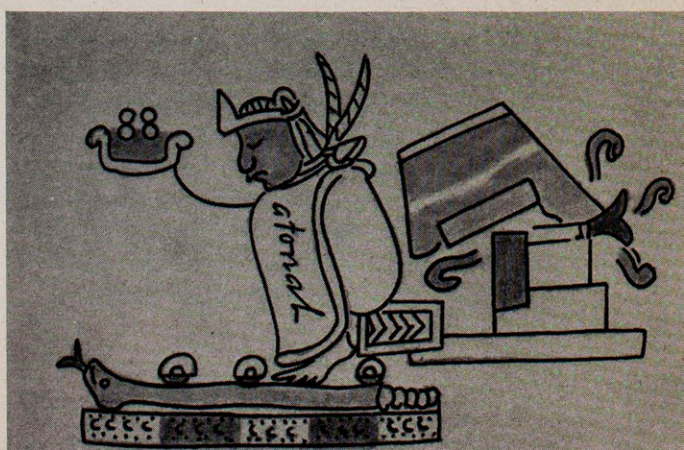
Hernando Cortez, and the conquistadores that followed him, wanted only gold and silver from the Indians, and cared not at all for the jade that had been offered as the natives' richest gifts. The determined efforts of the Spaniards, therefore, were directed toward extorting from the natives the location of all possible metal mining sites, while the secrets of jade production were not sought. Yet fortunately there were two or three Spaniards among the invaders who were sufficiently attracted by the strange culture they encountered to write descriptions of it, and even to copy some of the Indians' own hieroglyphic records. Their manuscripts were sent to Spain, where many were lost; but a few remained, and some others were found after years of forgotten storage, so that now they are available in certain research libraries.

The various volumes in which these histories have been collected are written in old Spanish, with inclusion of many words of the native languages, and often illumined with bright colored Indian pictures. For example, the learned Franciscan priest, Fr. Bernardino de Sahagun, was a devoted friend of the Indians, and had a lively interest in all that they did. In his "Cosas de Nueva Espana", Book XI, Chapter viii, this sprightly passage may be freely translated:

> "Precious stones are not found in the beautiful polished and brilliant condition in which they are sold by the vendors. They are originally rough, without appearance of beauty, and are brought from the fields and villages. There are

THE FALL OF COIXTLAHUACA
in the modern State of Oaxaca.

Its conquest is represented by the toppled and burning temple, in front of which is the mummy-pack of its defunct lord, Atonal, whose glyph is at the upper left: *atl*, water; *tonalli*, hot. The town is identified by the lower glyph: three eyes, above a serpent, *coatl*; on a piece of flat land, *ixtlauatl*.



persons who know where precious stones grow, because these, wherever they are, exhale at dawn a vapor, like delicate smoke. Another sign indicates the place where precious stones are hidden, especially in the case of those called chalchihuitls. Wherever these are present, the grass growing above them is always green for the reason that these stones continually send out a cool and moist exhalation. Where this occurs the stones are to be found in which the chalchihuitls are formed. This kind of stone is much used by the chieftains, who wear strings of them around their wrists, constituting a sign that the wearers are noblemen. It is illegal for vassals to wear them."

While these directions appear fantastic, apparently they were all that the Indians chose to tell the worthy Friar. They would not wish to divulge the actual localities from which they obtained the precious stones, but the manner of description does strengthen the belief that there are local deposits of jade mineral in Mexico.

Among other archives that also have been consulted are: the original "Matricula de Tributos" of which Archbishop Lorenzana wrote, "In these fragments one sees the most authentic testimony of the opulence, grandeur, and majesty of this Mexican Empire."; the "Antiquities of Mexico" reproduced by Lord Kingsborough from originals in Paris, Berlin, Dresden, Vienna, Rome, Bologne, and Oxford; the "Papales de Nueva Espana" and "Relaciones Geograficas de los Dioceses" by del Paso y Troncoso; the "Cronia Mexicana" by Tozozomoc; and the "Codex Vaticanus" now in the National Museum at Mexico City.

Most useful, however, for the present purpose of localizing the centers of jade carving in pre-hispanic Mexico, is the "Codice Mendocino". This is a compilation of the history of Moctezuma's Empire, gathered from the original court records by order of Antonio de Mendoza, Count of Tendillo, the first Viceroy of Mexico, who ruled there under authority of Charles the Fifth of Spain from 1535 to 1550. He was sympathetic to the plight of the Indians, and appreciated the cultural value of their archives. So he had copies made, which were arranged in three parts: (1) History of Conquests, (2) The Tribute Roll, and (3) Ethnography.

The first part consists of hand-colored hieroglyphs of all the towns that had been conquered by Ahuitzotl, who ruled in Mexico for 22 years until 1503, and by his nephew Moctezuma, emperor from then until he was dethroned by Cortez in 1519. The hieroglyphic record depicting the overthrow and burning of Coixtlahuaca (in what is now the State of Oaxaca), and the fall of its chief Atonal, is shown in the accompanying illustration.

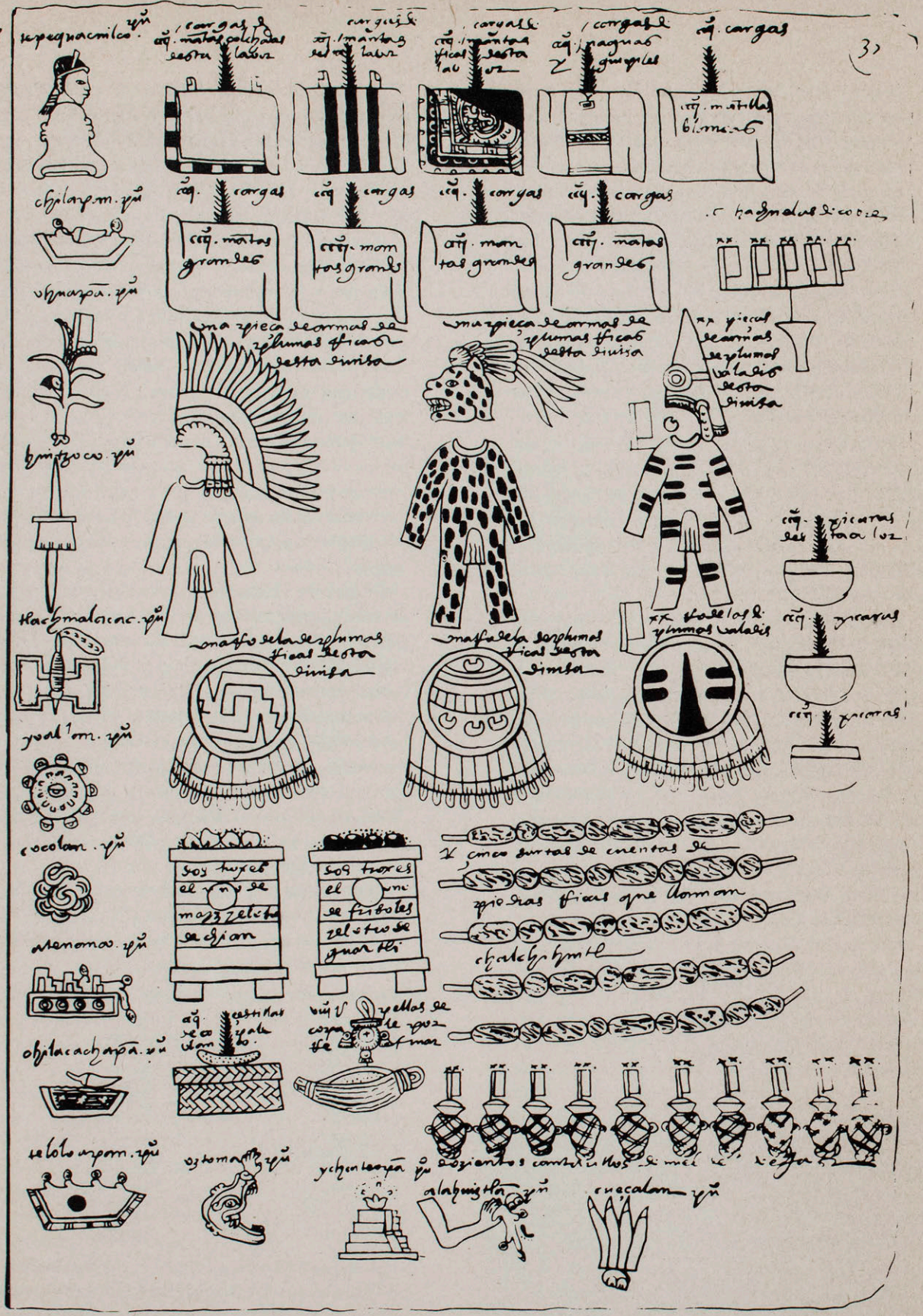
It is particularly the second part of this Codex, however, The Tribute Roll, that gives direct clues to the places where jade carving flourished. The Empire was divided into a number of subject areas that may be called provinces, designated by the name of the most important among the towns included within their boundaries. These provinces, with lists of their constituent towns, are portrayed in 55 Folios of part two of the Codex. These Folios consist of one page of text, describing the items and terms of tribute, facing a page of hand-painted pictures showing the glyphs of each conscripted town, and graphic representations of every kind of article required of them.

Of these 55 Folios, there are six that specify items of jade — indicated by the Nahuatl word "chalchihuitl". The first of these six defines the Tepecoacuilco Province, appearing as Folio 37, which is reproduced here to show the symbolic manner in which the records were depicted. Down the left-hand margin and along the bottom are listed the 14 towns that comprised the province, with the name of each one written above its hieroglyph. Then, on the rest of the page there are pictured the various articles of tribute, with designations of the required amounts of each.

Beginning at the upper left corner and reading down, the towns there enumerated are found to have been just east of the ancient Tarascan territory, in the present State of Guerrero:

ORIGINAL PLACE NAMES	NAMES ON PRESENT MAPS
1. Tepequacuilco	1. Tepecoacuilco
2. Chilapan	2. Chilapa
3. Ohuapan	3. Oapan
4. Huitzoco	4. Huitzuco
5. Tlachmalacac	5. Tlaxmalac
6. Yoallan	6. Iguala
7. Cocolan	7. Cocula
8. Atenanco	8. Atenango del Rio
9. Chilacachapan	9. Chilacachapa
10. Teloapan	10. Teloloapan
11. Oztoma	11. Magdalena
12. Ychateopan	12. Izcateopan
13. Alahuiztlan	13. Alahuixtlan
14. Cuecalan	14. Cuetzala

Except for Numbers 6 and 11, the similarity of the present names made it easy to find the correct position of these old towns on the excellent contour



FOLIO 37 recto, of the CODEX MENDOZA, showing the hieroglyphs of the fourteen towns comprising the Tepecoacuilco Province, in the modern State of Guerrero, and pictographs of the various articles of tribute required of them by the Lords of Mexico.

maps, on a scale of 1:500,000, of the quadrangle of the Republic (available at the Direccion General de Geografia in Tacubaya, D. F.). Those two, however, required a lot of search, which finally was rewarded by finding them identified in the recent scholarly paper by R. H. Barlow, "The Extent of the Culhua Mexica".

Among the items of tribute shown on the illumined page of Folio 37, the five strings of jade beads will be seen pictured in the lower right quadrant. It was just for these, and the corresponding tributes of carved jade specified on Folios 43, 46, 47, 49, and 52, that this search was undertaken; for it seemed reasonable to suppose that the lapidaries of the 68 towns therein named must have had some quarries of raw stone — fairly easily available — to supply their yearly demand. Such was the sole purpose of this study; but in Mexico archeological interest is not to be denied, and so all the hieroglyphs of tributes required from the 14 towns here illustrated will be explained by a free translation of the descriptive text:

"The number of towns in the hot lands, depicted and named in the following plan, is fourteen.

FIRST, four hundred bundles of quilted robes, four hundred bundles of black and white striped robes, four hundred bundles of rich robes, four hundred bundles of petticoats and huipiles, four hundred bundles of white mantillas, one thousand six hundred bundles of large robes; all of which shall be contributed every six months.

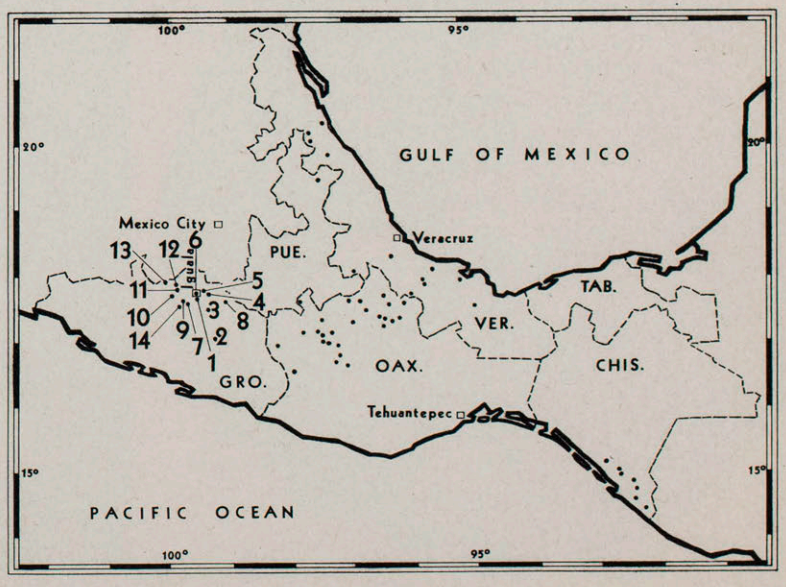
NEXT, six hundred little copper hatchets, one thousand two hundred yellow-varnished bowls, two hundred little jars of bee's honey, four hundred baskets of white resin and burners, eight thousand lumps of unrefined resin such as are used in censers; all of which shall be contributed every eighty days.

NEXT, two pieces of armor with their shields ornamented with rich feathers arranged as depicted, twenty pieces of armor with their shields ornamented with crenulated feathers, five strings of precious stones called chalchihuitl, four large granary-cribs of the size shown below filled with corn and beans and sage and guantli; all of which shall be contributed once a year."

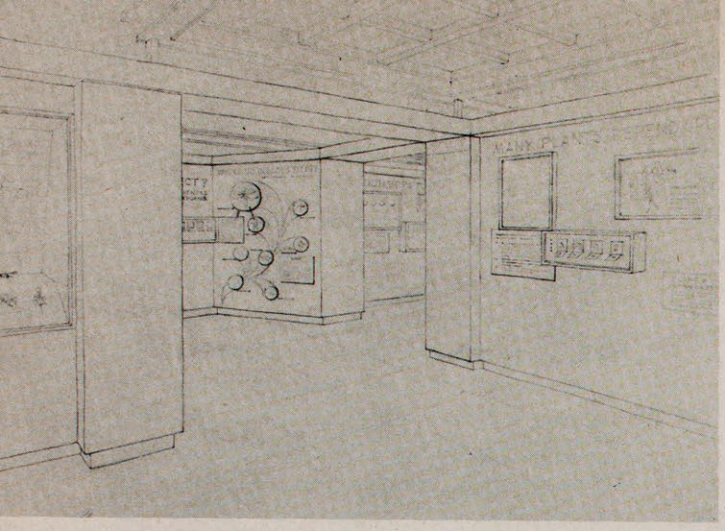
NOTE: In these translations valuable advice was given by Profesora Ana Maria Cortes Herrera.

Available space is not sufficient to allow of detailed presentation and discussion of the other five Folios of the Codice Mendocino, but the positions of the 68 towns that gave tribute of jade to Moctezuma are shown on the accompanying map of southern Mexico. Although, for clarity, rivers and roads have been omitted from this map, the regions occupied by the more-or-less closely associated (usually ethnic groups) can be recognized by reference to the present boundaries of the several States.

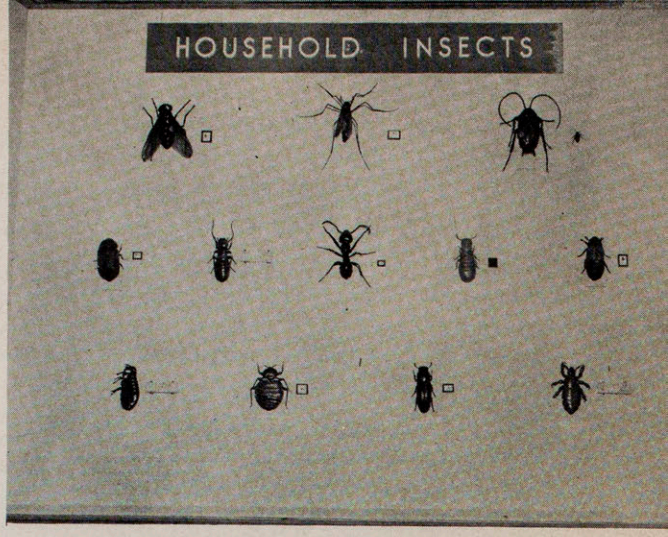
Raymond J. Barber
Curator of Mineralogy and Petrology



MAP OF SOUTHERN MEXICO,
with dots indicating the position of the 68 towns that contributed jade to Moctezuma. Those identified by numbers, in the State of Guerrero, are the fourteen named on Folio 37 of the Codex Mendoza, as listed on page 15.



Artists's concept of the entrance to the Hall of Entomology. Designed by Henry Anson Wylde, Division of Exhibitions.



These are our enemies! Display of household insect pests illustrated by large-scale balsa-wood models carved with scientific accuracy from the actual specimens.

Our Amazing Insects

(The Hall of Entomology)

"The struggle between man and insects began long before the dawn of civilization, has continued without cessation to the present time, and will continue, no doubt, as long as the human race endures."[1] This is due to the fact that both man and certain insects constantly want the same things at the same time. On the other hand, man derives many benefits from the insects which brings about a balance of the good against the evil. Insects are the principal means of fertilizing the flowers of our fruit trees and vegetable crops. They produce many items of commercial value. They are the scavengers of nature, the curbs on overproduction of weed plants, and the stirrers of the soil. The question then arises, "How can one distinguish the good from the evil?". This is only one of the many questions that the Los Angeles County Museum is attempting to answer graphically in its new Hall of Entomology now under construction on the north mezzanine.

The amazing variety and specialization of habit and appearance, the extraordinary adaptations and "shifts for a living" which insects show, make a claim on the attention of all who harbor the smallest trace of that scientific curiosity which leads men to observe and ponder the ways of nature.

[1]FORBES, S.A.., "The Insect, the Farmer, the Teacher, the Citizen, and the State," Bul. Ill. State Lab. Natural History, 1915.

The importance of recognizing the lowly insect has evolved in Mr. Average Citizen (if for no other reason) because of its sheer abundance. Where, however, can one gain the knowledge required to understand this fabulous world of insects? Your Museum, in keeping with the newer techniques of museum exhibition where mere collections of the bizarre and the interesting are being replaced by a living story, presents the Hall of Entomology. This exhibition, a collaborative effort of the Science and Exhibitions Divisions of the Museum, is scheduled to open in the fall. It will depict some of the outstanding characteristics of insects and their relatives, and ways in which they affect the lives of man, his animals, his plants and even his products.

Our presentation of Entomology will fall generally into the following categories:

INTRODUCTION AND ORIENTATION

- Introduction
- Orientation
- Arthropod Relationships
- Non-insect Arthropods
- Modern Orders of Insects

HISTORY

- Antiquity of Insects
- Fossil Insects

NATURAL HISTORY

Eggs
Complete and incomplete metamorphosis
Fundamentals of Feeding
Color
Protection
Camouflage
Ecology
Geographic Variation
Exotics

FUNCTIONS

External Anatomy
Internal Anatomy
Locomotion
Communication
Intelligence vs. Instinct
Insect Adaptation to Plants

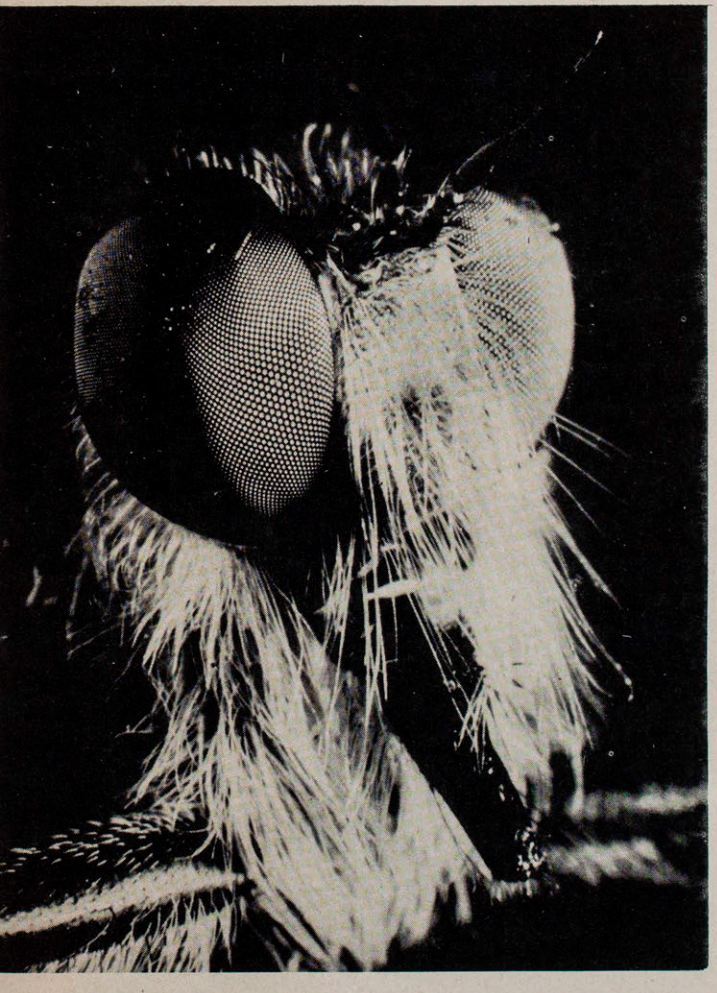
WORK OF THE INSECT

Insect Pollination
Insects of the Home
Common Insects of the Garden
Insect Societies
Insect Architecture
Insect Products
Insects and Disease

In the exhibits on Protection and Camouflage, one finds that the insect has many ingenious ways of protecting itself, both in body form and color pattern and in its mode of living. Protection of life suggests grim violence and in this man and insects have many devices in common. The struggle for survival that has continued without cessation in practically every group of living organisms has developed and refined the adaptations for concealment. Long before the camouflaging of gun emplacements in man-made war, the insects had mastered this art for both offensive and defensive purposes.

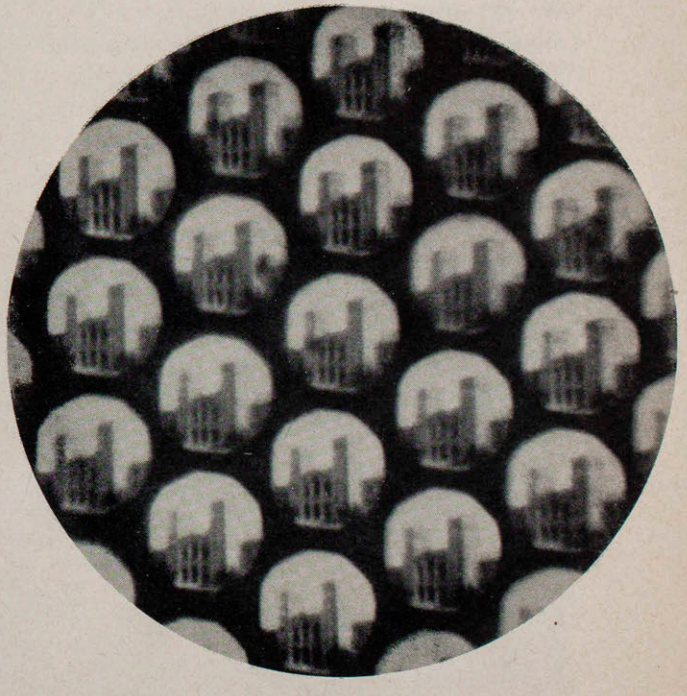
Head of a fly illustrating the compound eye, chief visual organ of insects. Each small hexagon is a lens.

Photo by Edwin W. Teale

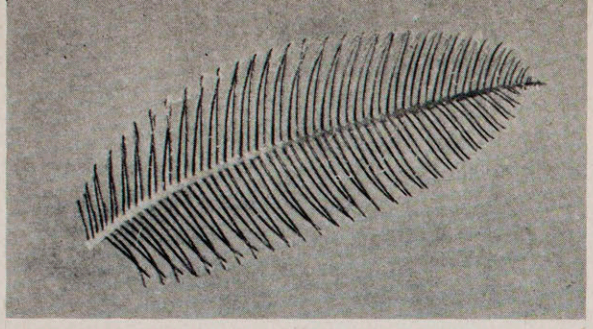


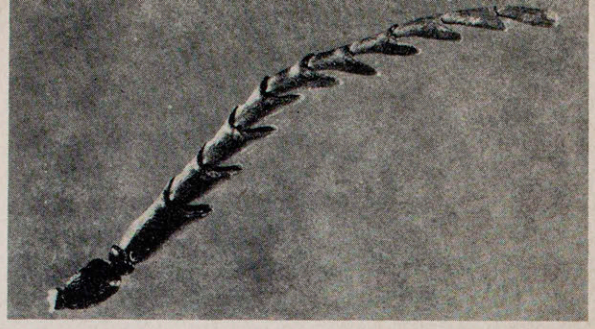
Through the eye of a fly! Photograph was taken through a portion of the cornea of the compound eye of a dragonfly mounted under a microscope. The image of Royce Hall was reflected with a mirror. (Approx. X 300).

Photo by Roy J. Pence



Demonstrations such as these will be accomplished with photo transparencies in the Hall of Entomology.





COMMUNICATION. Insect antennae bear receptors capable of hearing, feeling, tasting and smelling. Antenna of moth (left), of beetle (right).

Photos by Lewis Athon

"How do insects breathe? Do they have a heart and blood? How do they communicate with each other?" The exhibits will graphically portray the answers to these and many other questions in the Anatomy display.

In another exhibit, "Insect Societies", one finds that many of man's social structures resemble the insect's life patterns. Multiple dwelling units in today's housing and the Co-op plan in the farm Grange, the sewing bee, and the threshing season, all point to examples long a part of insect life and economy.

In three exhibits, the theme is insects detrimental to man. How does one recognize these insects and their damage and how must they be controlled? "Know your enemy" and fewer problems remain unsolved. Knowledge of life habits and behavior is the answer to prevention of insect damage and makes possible the saving of millions of dollars annually. In these displays, as is so often the case when the creatures involved are small, exhibition problems immediately arise. To partially offset this difficulty, photographic color-transparencies, drawings and charts will be used to bolster the insect specimens themselves. To illustrate the exhibits on insect pests, however, the Museum Association has made it financially possible to purchase a series of large-scale models carved with scientific accuracy from the actual specimens. The curators of Entomology think that they have found the Michelangelo of Entomology in the discovery of the lad who carves these models. He is Carl Gage, an 18 year old freshman at Los Angeles City College.

To the student of insects there is a great appeal in the marvelous beauty of color, sculpture, and vestiture; in the strange and infinitely varied forms; in the protective mimicry; in the mysterious transformations from egg, through larva and pupa, to the altogether different adult. Many insects are to be treated with admiration and respect. Intrinsic beauty, marvelous organization in minute bodies, complicated social life, and valuable products call for interesting and instructive exhibits.

To be sure, some of the insects will be treated as enemies, but enemies that we can meet only if instructed. The lowly insect is generally considered with loathing and fear. It is sincerely hoped that the Museum through its Hall of Entomology can create a new viewpoint.

Fred S. Truxal
Curator of Entomology

FOSSIL INSECTS. A fossil bee from the Florissant shale of Colorado, estimated to be 40 million years old.

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Signa L. Broline, Membership Secretary, RIchmond 2194

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